

REPORT ON THE CONSERVATION STATUS OF
Lesquerella carinata var. languida, A CANDIDATE THREATENED SPECIES

Taxon Name:	<u>Lesquerella carinata</u> var. <u>languida</u> Rollins
Common Name:	Garnet bladderpod
Family:	Brassicaceae
States Where Taxon Occurs:	Montana
Current Federal Status:	USFWS Notice of Review, Category 2
Recommended Federal Status:	USFWS Notice of Review, Category 1
Author of Report:	Jim Vanderhorst
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Date of Most Recent Revision:	N/A
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• 1995 Montana Natural Heritage Program

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TABLE OF CONTENTS

	<u>Page</u>
I. SPECIES INFORMATION	
1. Classification and nomenclature	1
2. Present legal or other formal status.	2
3. Description	4
4. Significance.	6
5. Geographical distribution	9
6. General environment and habitat description	14
7. Population biology of the taxon	20
8. Population ecology of the taxon	27
9. Current land ownership and management responsibility.	29
10. Management practices and experience	30
11. Evidence of threats to survival	32
II. ASSESSMENT AND RECOMMENDATIONS	
12. General assessment of vigor, trends, and status	34
13. Recommendations for listing or status change.	35
14. Recommended critical habitat.	36
15. Conservation/recovery recommendations	37
16. Interested parties.	39
III. INFORMATION SOURCES	
17. Sources of information.	41
18. Summary of materials on file.	42
IV. AUTHORSHIP	
19. Initial authorship.	42
20. Maintenance of status report.	42
V. NEW INFORMATION	
21. Record of revisions	42
Literature Cited	43
Appendix A: Element Occurrence Records and maps.	46

I. SPECIES INFORMATION

1. Classification and nomenclature.

A. Species.

1. Scientific name.

- a. Trinomial:** Lesquerella carinata var. languida Rollins
- b. Full bibliographic citation:** For the variety, Lesquerella carinata var. languida: Rollins, R. C. 1993. The Cruciferae of Continental North America. Stanford University Press, Stanford, CA. For the species, Lesquerella carinata: Rollins, R. C. 1950. Studies on some North American Cruciferae. Contributions of the Gray Herbarium 1717:42-53.
- c. Type specimens:** Lesquerella carinata var. languida: Rattler Gulch, Granite County, Montana, 12 June 1990, Lisa Ann Schassberger 364 (Gray Herbarium, Harvard University). Lesquerella carinata: Birch Creek, Lemhi County, Idaho, 3 July, 1941, Ray J. Davis 3801 (Gray Herbarium).

2. Pertinent synonyms: none

3. Common name: Garnet bladderpod

4. Taxon codes: PDBRA1N0B1.003

5. Size of genus: about 95 species, 83 in North America, with a center of diversity in the southwestern and western part (Rollins 1993).

B. Family classification.

1. Family name: Brassicaceae

2. Pertinent family synonym: Cruciferae

3. Common names for the family: Mustard Family

C. Major plant group: Dicotyledoneae

D. **History of knowledge of taxon:** Lesquerella carinata var. languida was first collected in 1977 by Klaus Lackschewitz from the vicinity of Rattler Gulch, Granite County, Montana, although at the time the variety had not yet been described. Earlier reports of the species, Lesquerella carinata, from the state (Hitchcock and Cronquist 1973) are presumably based on a collection from Emerine Gulch in the Sapphire Mountains, Granite County, a population which was redetermined by Dr. R. C. Rollins (Harvard University), in 1990, to be Lesquerella paysonii. The second collection of Lesquerella carinata var. languida was taken in 1986 by Peter Lesica from cliffs above Bear Creek about 7 miles west of Rattler Gulch. In 1989 and 1990, Lisa Ann Schassberger conducted field surveys for Lesquerella carinata in Granite County, taking collections from the previously reported sites at Rattler Gulch, Bear Creek, and Emerine Gulch and from newly discovered populations (or subpopulations) at Mulkey, Packer, and Felan Gulches in the Garnet Range (Schassberger 1991). All of these specimens were sent to Dr. Rollins, and in the fall of 1990, he determined that plants from Emerine Gulch were actually Lesquerella paysonii, and plants from the other locations represented a separate taxon from Idaho and Wyoming populations of Lesquerella carinata, "perhaps at the subspecific level" (letter to the Montana Natural Heritage Program, Nov. 20, 1990). Three years later, Rollins described this taxon as Lesquerella carinata var. languida, citing the collections from Rattler Gulch, Bear Creek, Mulkey Gulch, Felan Gulch, and Packer Gulch (Rollins 1993), but not those from Emerine Gulch. In 1991 through 1994, the population biology and ecology of the taxon at Rattler Gulch, Mulkey Gulch, and Bear Creek was studied by Jack Greenlee (Greenlee 1994; Greenlee and Callaway, in progress). In the spring of 1994, the author of this status review conducted field surveys for Lesquerella carinata var. languida in Granite County with an emphasis on expanding its known range, resulting in the discovery of additional populations (or subpopulations) in the Garnet Range, but none at any great distance from the previously known sites.

E. **Comments on current alternative taxonomic treatments:** none

2. **Present legal or other formal status.**

A. **International.** none

B. National.

1. United States.

- a. Present designated or proposed legal protection or regulation:** Lesquerella carinata is included in Category 2 of the U. S. Fish and Wildlife Service Notice of Review (USDI Fish and Wildlife Service 1993). This designation is for the entire species, including L. carinata var. languida. Category 2 taxa are those "for which information now in possession of the Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which sufficient data on biological vulnerability and threat are not currently available to support proposed rules."

The U.S. Forest Service Region 1 includes L. carinata var. languida on its sensitive species list (USDA Forest Service 1994a) and the Bureau of Land Management includes the taxon on its list of proposed sensitive plants (USDI Bureau of Land Management 1993).

- b. Other current formal status recommendations:** Listed as G2T1 by The Nature Conservancy (Heidel 1994). This means the entire species is "imperiled due to rarity," while the variety, Lesquerella carinata var. languida is "critically imperiled because of extreme rarity."
- c. Review of past status:** In 1980, Lesquerella carinata was listed as having 3C status (USDI Fish and Wildlife Service 1980). This category signifies that a taxon is no longer under review for listing as Endangered or Threatened. In 1985, Lesquerella carinata was again listed as 3C (USDI Fish and Wildlife Service 1985). In 1993, the species was elevated to C2 status (USDI Fish and Wildlife Service 1993), based on the recommendations of a Wyoming interagency meeting, without consultation with Idaho authorities. It is appropriate to treat the status of Lesquerella carinata var. carinata separate from L. c. var. languida.

2. State.

a. Montana.

- i. Present designated or proposed legal protection or regulation: none
- ii. Other current formal status recommendations: Lesquerella carinata var. languida is currently listed as S1 by the Montana Natural Heritage Program (Heidel 1994), meaning that it is "critically imperiled because of extreme rarity (5 or fewer occurrences) in Montana."
- iii. Review of past status: The populations of Lesquerella carinata var. languida were previously tracked by the Montana Natural Heritage Program as Lesquerella carinata, with a state rank of S1 (Lesica and Shelly 1991, Heidel and Poole 1993).

3. Description.

- A. General nontechnical description: Lesquerella carinata var. languida is a small, low growing, short lived, herbaceous perennial. The basal leaves are stalked, with elliptical to round shaped blades, and form a rosette which arises from a generally unbranched underground stem. The foliage is densely covered with hairs which give a silvery cast to the plants. The flowering stems, which exceed the basal rosette and usually hug the ground, bear smaller leaves and several to many flowers. The flowers consist of 4 green sepals, 4 yellow petals, 6 stamens, and a single ovary. The mature fruit are elliptical in outline and are keeled, especially on the back, but also on the sides. The style is prominent and persistent.

- B. Technical description: For the species, Lesquerella carinata (Rollins 1993):

Perennial, densely pubescent; caudex simple, small, trichomes radiate, sessile or on a short

stalk, rays forked or sometimes bifurcate, finely granular; stems decumbent, usually unbranched, 0.5-1.5(-2) dm long; basal leaves elliptical to broadly obovate or round, petiolate, 1.5-3(4) cm long; cauline leaves few, oblanceolate to obovate, sessile or on a narrowed base, 0.5-1.5 cm long; petals yellow, 7.5-10 mm long; fruiting pedicels straight to loosely sigmoid, ascending or divaricately spreading, 4-10 mm long; siliques sessile to substipitate, elliptical, strongly compressed contrary to the plane of the septum, 5-9 mm long, valves sharply keeled at back, edges forming \pm of a keel, pubescent on exterior and interior; styles 2-4.5(-5) mm long; ovules (2-)4-7 per locule; seeds only slightly flattened, neither margined or winged.

Diagnostic characters for the variety, Lesquerella carinata var. languida (Rollins 1993):

Styles 4-5 mm long; ovules 2-3(-4) per locule; infructescence lax and elongated.

- C. **Local field characters:** Although Lesquerella carinata var. languida typically grows at sites without other species of the genus, Lesquerella alpina has been documented at one population site, and, as discussed below (I.5.B.6.a.), Lesquerella paysonii, which occurs in Granite County in the Sapphire Range, has been mistaken in the past for Lesquerella carinata var. languida. Lesquerella alpina is easily distinguished by having fruits which are not compressed or keeled, and which are borne on flowering stems which are erect rather than hugging the ground as in Lesquerella carinata var. languida. In addition, the leaves of Lesquerella alpina are narrower, often nearly linear, and lack obvious petioles. Lesquerella carinata var. languida is more difficult to distinguish from Lesquerella paysonii. Both of these species have siliques which are obcompressed (i.e. flattened at a right angle to the plane of the septum), but the siliques of Lesquerella carinata var. languida have valves which are strongly keeled on the midline, are quadrangular in cross section, and have their replum margins obscured, being covered by the valves (Rollins 1993). The siliques of Lesquerella paysonii, in contrast, have valves which are rounded along the midline, are not quadrangular in cross section, and the replum margins are exposed (Rollins 1993). In Garnet County, plants of Lesquerella

carinata var. languida average larger than those of Lesquerella paysonii, and have longer, more lax infructescences.

- D. **Identifying characteristics of material which is in interstate or international commerce or trade:** not known from commerce or trade
- E. **Photographs and line drawings:** Figure 1 is a photograph of Lesquerella carinata var. languida and Figure 2 is an illustration of the species, Lesquerella carinata var. carinata.

4. Significance.

- A. **Natural:** Lesquerella carinata var. languida appears to be endemic to a small area of the Garnet Mountains in Granite County, Montana, thus having one of the most limited known distributions of plant taxa in the Rocky Mountains. Populations are confined to soils and lithic substrates derived from Madison limestone, and the parent material of much of the population areas has been determined to be high calcium limestone. Limestone endemism is probably the most common type of endemism in Montana, but the reasons for this phenomenon are poorly understood. Two possible mechanisms for the adaptation and confinement of Lesquerella carinata var. languida to limestone substrates which have been suggested (Schassberger 1991) involve the geochemistry of the substrate and the low levels of competition in the habitat. An additional factor may be the physical properties of the substrate, especially as they affect water relations, and how they relate to the plants' morphology and life history.
- B. **Human:** Lesquerella carinata var. languida may have value as a source of genetic variation for crop improvement. Many species of the genus Lesquerella have been screened for their potential as oil seed crops (Barclay et al. 1962), and one, L. fendleri, is currently being domesticated by the U. S. Department of Agriculture (1991). This new crop shows promise as a source of hydroxy fatty acids for industrial uses and as a high protein livestock feed supplement. The diversity within the genus and its outcrossing genetic system provide plant breeders with opportunities for crop improvement. Wild relatives of domesticated plants have great potential commercial value as sources of genetic diversity for plant breeding (Iltis 1988).



Figure 1. Xerox of Lesquerella carinata var. languida specimens
(Vanderhorst 5173)

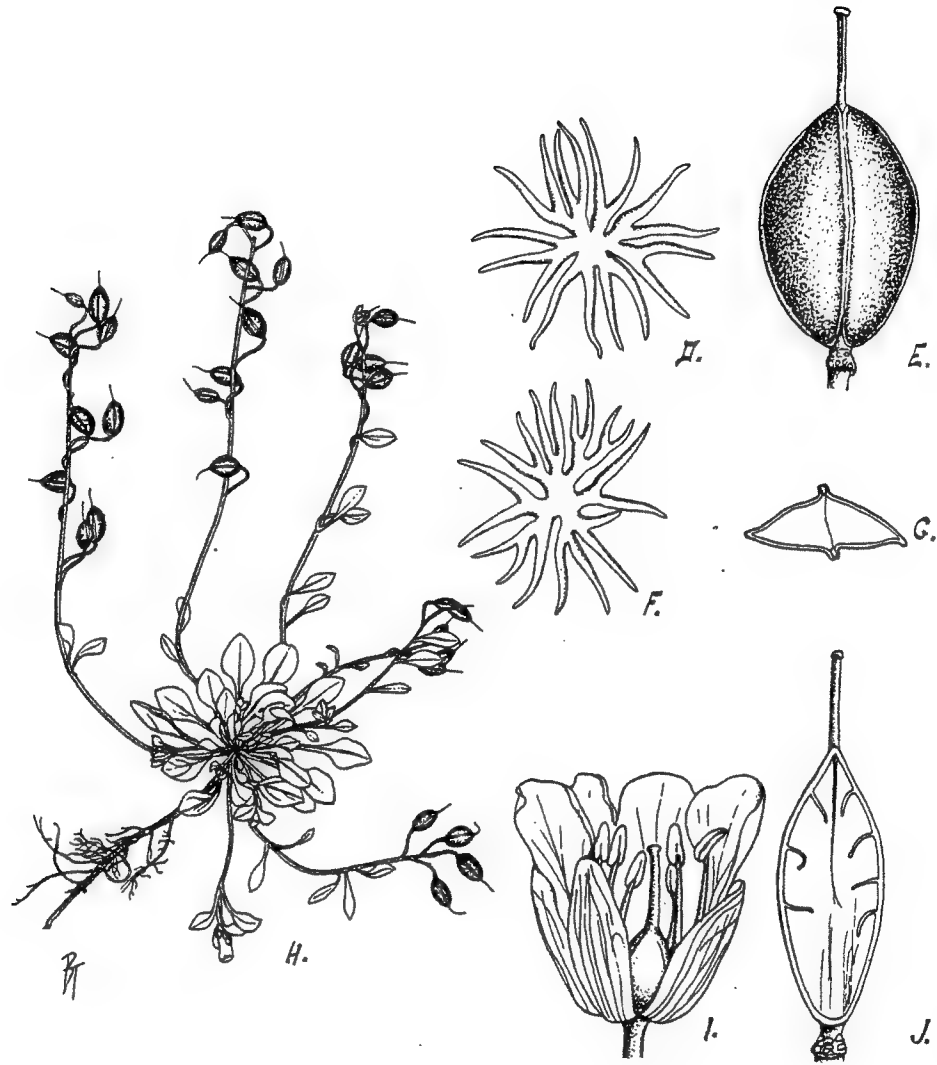


Figure 2. Line drawings of Lesquerella carinata (by B. Tugendhat, in Rollins and Shaw 1973). E. silique; F. trichome; G. cross section of silique; H. habit; I. flower; J. dehiscent silique showing replum and funicles. **Note:** These drawings were made before the discovery of Lesquerella carinata var. languida and thus represent the nominate variety. Lesquerella carinata var. languida differs in having longer styles, fewer ovules (indicated by number of funicles) per locule, and more lax and elongated infructescences (Rollins 1993).

5. Geographical distribution.

A. **Geographical range:** Lesquerella carinata var. languida is known only from the vicinity of Bear Creek and Mulkey and Rattler Gulches in the Garnet Mountains in Granite County, Montana. Figure 3 is a map showing the known distribution of the taxon.

B. Precise occurrences.

1. **Populations currently known to be extant:**
There are now four occurrences of Lesquerella carinata var. languida entered in the Biological Conservation Database maintained by the Montana Natural Heritage Program. These are referred to below by the site names and occurrence numbers given on their Element Occurrence Records, which are included in Appendix A of this status review along with topographic maps showing the precise locations.

a. Bear Creek (001)

1. **USGS 7.5' quadrangle:** Elevation Mountain
2. **Legal description:** T12N R14W S34 NW 1/4
3. **Elevation:** 1,295-1,448 meters (4,250-4,750 feet)
4. **First observation:** 1994
5. **Last observation:** June 3, 1994
6. **Directions:** From Bearmouth on Interstate 90, travel ca. 4.9 kilometers (3 miles) up Bear Creek. Population is above cabin east of road on south-facing slopes above unnamed gulch.

b. Rattler Gulch (003)

1. **USGS 7.5' quadrangles:** Bearmouth and Drummond
2. **Legal description:** T11N R13W S9 (NW 1/4, NE 1/4 of SE 1/4), S4 (SE 1/4 of SW 1/4, SW 1/4 of SW 1/4), S5 (SE 1/4, SE 1/4 of NW 1/4, SW 1/4 NW

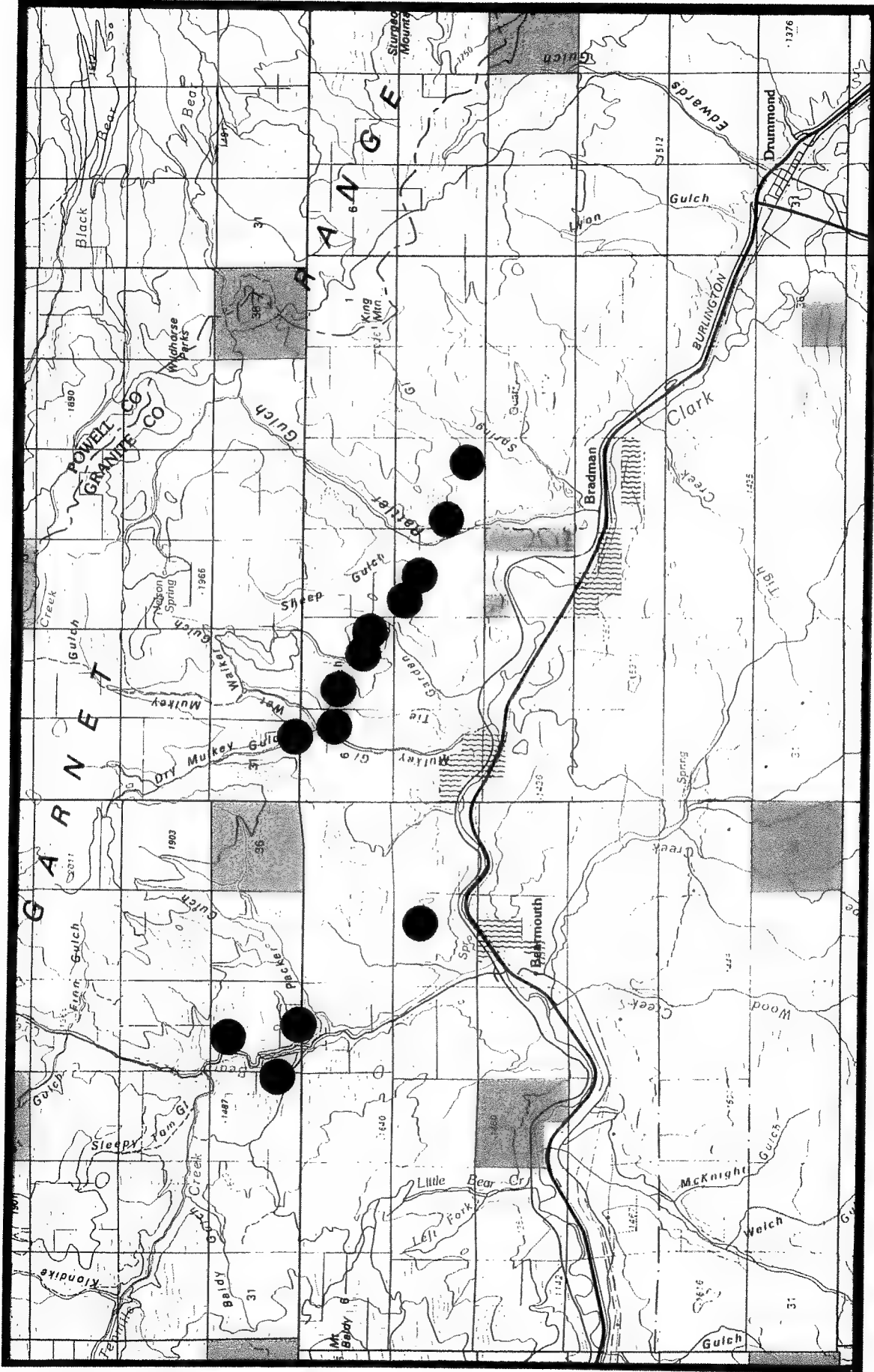


Figure 3. Map showing the distribution of *Lesquerella carinata* var. *languida*, Granite County, Montana. Black dots indicate approximate locations of all known subpopulations. BLM lands are yellow, state lands are blue. Missoula East 1:100,000-scale metric topographic map (USDI Bureau of Land Management 1989).

1/4), S6 (NE 1/4 of SE 1/4, NE 1/4 of NE 1/4), S10 (E 1/2, W 1/2); T12N R13W S31 (SE 1/4 of SE 1/4)

3. **Elevation:** 1,234-1,707 meters (4,050-5,600 feet)
4. **First observation:** 1977
5. **Last observation:** May 31, 1994
6. **Directions:** Ca. 8 kilometers (5 miles) east of Drummond. Subpopulations extend from ca. 1.6 kilometers (1 mile) east of Rattler Gulch west to Mulkey Gulch, 3.2 kilometers (2 miles) west of Rattler Gulch.

c. Bear Creek Cliffs (004)

1. **USGS 7.5' quadrangle:** Bearmouth
2. **Legal description:** T11N R14W S11 (NW 1/4)
3. **Elevation:** 1,402 meters (4,600 feet)
4. **First observation:** 1986
5. **Last observation:** May 26, 1989
6. **Directions:** Cliffs above east side of Bear Creek, ca. 2 air kilometers (1.3 miles) north-northeast of Bearmouth, ca. 0.64 air kilometers (0.4 miles) north of Clark Fork River.

d. Felan and Packer Gulches (005)

1. **USGS 7.5' quadrangle:** Bearmouth
2. **Legal description:** T12N R14W S33 (SE 1/4), S34 (SW 1/4); T11N R14W S3 (NW 1/4)
3. **Elevation:** 1,341 meters (4,400 feet)
4. **First observation:** 1989
5. **Last observation:** June 6, 1990

6. **Directions:** Bearmouth Area, Felan and Packer Gulches, ca. 3.7 kilometers (2.3 miles) north of Interstate 90 up Bear Creek.
2. **Populations known or assumed extirpated:** none
3. **Historically known populations where current status is not known:** none
4. **Locations not yet investigated believed likely to support additional natural populations.** Potential habitat for Lesquerella carinata var. languida that has not been explored occurs to the east of the Rattler Gulch population, on the south flank of the Garnet Range to the southeast of Spring Gulch (T11N R13W S14). This location has vegetation, aspect, and geology (Landreth 1968) similar to the Rattler Gulch occurrence. Additional potential habitat may occur between Bear Creek and Mulkey Gulch (e.g. T12N R14W S36, a Montana state school section) on geological substrates mapped as the Madison Group (Kauffman 1963). Private property in the area has not generally been surveyed. Additional potential habitat may occur on BLM and private land in the canyon of Bear Creek.
5. **Reports having ambiguous or incomplete locality information:**
 - a. **Montana:** Hitchcock and Cronquist (1973) cite a Granite County distribution for Lesquerella carinata. This probably refers to the population of Lesquerella paysonii near Emerine Gulch (see I.5.B.6.a. below).
6. **Locations known or suspected to be erroneous reports:**
 - a. **Montana:** Until 1990, a population of Lesquerella in southern Granite County, in the vicinity of Emerine Gulch, was referred to as Lesquerella carinata (Lesica and Shelly 1991, Schassberger 1991). The identity of this population was reevaluated by Dr. R. C. Rollins, a specialist in the genus, and was determined to be Lesquerella paysonii. Subsequent referral to this population as

Lesquerella carinata var. languida by the Montana Natural Heritage Program and by Greenlee (1994) were based on misinterpretations of letters from Rollins. Among the points of confusion is the specimen of Lesquerella carinata var. languida collected from Bear Creek Cliffs (Lesica 3697). The label states that the collection site is on the "north side of the Clark Fork River, 1/2 mile west of Maukey Gulch," however, Maukey Gulch is in the Sapphire Range in southern Granite County, to the east of the Emerine Gulch population of Lesquerella paysonii; Lesica was probably referring to Mulkey Gulch, which is to the east of Bear Creek in the Garnet Range. Rollins (1993) does not cite the Emerine Gulch population in his description of Lesquerella carinata var. languida. Another population which was referred to as Lesquerella carinata in the past is in southern Montana in the Centennial Mountains, Beaverhead County. This determination was based on material without mature fruit; subsequent collections with mature fruit were sent to Dr. Rollins who determined that these plants belong to an undescribed taxon which is also found in Beaverhead County in the vicinity of the Pioneer Range (Heidel 1993).

- C. **Biogeographical and phylogenetic history:** Rollins and Shaw (1973) included Lesquerella carinata in an informal group (Group 8) within the genus with L. douglasii, L. fremontii, L. garrettii, L. macrocarpa, L. multiceps, L. occidentalis, L. paysonii, L. prostrata, L. utahensis, and L. wardii. More specifically, they say that Lesquerella carinata "seems to represent an extreme of the evolutionary line of development which led to it through L. paysonii, and in spite of the carinate siliques it should be associated with the L. wardii-L. utahensis group." Lesquerella wardii and L. utahensis are Utah endemics which Rollins and Shaw believed to have a close relationship with L. kingii (in their Group 9), a species with a broader distribution in the Great Basin (Oregon, California, Utah, Nevada). Lesquerella carinata thus seems most closely related to L. paysonii. The two species have similar distributions, both occurring in Granite County, Montana, but they are not known

to occur together at the same site, and, in general, the range of Lesquerella carinata is slightly to the west (Rollins and Shaw 1973). The phylogenetic relationship of Lesquerella carinata to recently discovered, as yet undescribed, species of Lesquerella in Montana has not been commented on. It should be emphasized that Rollins and Shaw (1973) considered their phylogenetic groupings to be speculative and informal, and in a more recent treatment of the genus (Rollins 1993), no comments were made on phylogeny and the species were ordered alphabetically. The genus has not been the subject of modern molecular or cladistic phylogenetic analysis.

Lesquerella carinata var. languida is geographically isolated from Lesquerella carinata var. carinata, which occurs at higher elevations in the mountains of western Wyoming and central Idaho (Rollins 1993). Rollins and Shaw (1973) considered many-ovuled siliques to precede few-ovuled siliques in a given evolutionary line, which would indicate that Lesquerella carinata var. carinata is the more primitive taxon. Lesquerella carinata var. carinata also has a much broader range, in keeping with a longer history. Geographic isolation appears to be the mechanism of speciation for some Lesquerella species, as evidenced by hybridization between species brought together by recent human activity (Rollins and Shaw 1973). Although data are lacking on interfertility, the distributions of Lesquerella carinata var. languida and its close relatives Lesquerella carinata var. carinata and Lesquerella paysonii are consistent with the geographical mode of speciation (Grant 1981).

6. General environment and habitat description.

- A. **Concise statement of general environment and habitat:** Lesquerella carinata var. languida occurs west of the Continental Divide in a small area of the Garnet Range. It is confined to substrates derived from Madison limestone, and at least much of its range is confined to a zone of high calcium limestone. Lesquerella carinata var. languida grows in loose, gravelly soils, usually on steep, southerly exposed slopes with a hot, dry microclimate. It grows in the ponderosa pine zone, in open woodlands, bitterbrush shrublands, grasslands, and on barren scree slopes.

B. Physical characteristics.

1. Climate.

- a. **Koppen climate classification:** Type Dfb (Visher 1954). This signifies a microthermal, or cold climate (D) with humid winters (f) and cool summers (b) (Trewartha and Ward 1983).
- b. **Regional microclimate:** The nearest climatological stations to the populations of Lesquerella carinata var. languida where long term data have been reported (USDC National Oceanic and Atmospheric Administration 1982) are Missoula, at a lower elevation (972 meters or 3,190 feet) than all populations, and Philipsburg Ranger Station, at a higher elevation (1,606 meters or 5,270 feet) than most of the population areas. For Missoula, the 30 year normals (1951-1980) of mean monthly temperature ranged from 21.3° F in January to 67.2° F in July and the normal annual precipitation was 33.75 centimeters (13.29 inches), with two peak seasons, one in winter (Dec.-Jan.) and the other in spring (April-June). For Philipsburg, mean monthly temperature normals ranged from 21.3° F in January to 61.3° F in July, and normal annual precipitation was 36.12 centimeters (14.22 inches) with a peak in May and June.
- c. **Local microclimate:** The population sites of Lesquerella carinata var. languida are relatively hot, dry sites. Most sites are steep, open slopes with southerly aspects. These slopes have high solar exposure and low snow and water retention. A subpopulation of the Packer and Felan Gulch population (005) occurs on more mesic west facing slopes with a higher canopy cover (Greenlee 1994). Microclimate seems to be an important factor in the population dynamics and ecology of Lesquerella carinata var. languida (Greenlee 1994, Greenlee and Callaway, in progress).

2. **Air and water quality requirements:** not known

3. **Physiographic province:** Northern Rocky Mountain Province (Fenneman 1931).
 4. **Physiographic and topographic characteristics:** Lesquerella carinata var. languida grows at elevations from 1,219-1,707 meters (4,000 to 5,600 feet) on slopes of the southern flank and canyons of the Garnet Mountains, a range situated west of the Continental Divide. All known populations occur on or downslope from geologic formations mapped as the Madison Group (Kauffman 1963).
 5. **Edaphic factors:** All populations of Lesquerella carinata var. languida grow in loose, gravelly soils derived from the Mission Canyon limestone of the Madison Group (Schassberger 1991, for geological maps of the area see Kauffman 1963). The Rattler Gulch population occurs on a band of high calcium limestone mapped and sampled by Landreth (1968). The limestone in this zone is greater than 95% CaCO_3 and less than 3% MgCO_3 by weight. Figure 4 is a map of the Rattler Gulch population (003) superimposed on Landreth's map of the high calcium zone. The limestone at other population sites has not been sampled. It appears that the species is restricted by soil parent material, but it is not known whether this is due to chemical or physical properties of the soil or to low competition from other plants at these sites (Schassberger 1991).
 6. **Dependence of this taxon on natural disturbance:** Lesquerella carinata var. languida usually grows on steep slopes with loose, easily disturbed surface substrate. Natural shifting and disturbance caused by game may play a role in the plant's community structure and seed dispersal as well as in the vegetative physiognomy of the sites.
 7. **Other unusual physical features:** none known
- C. **Biological characteristics.**
1. **Vegetation physiognomy and community structure:** Lesquerella carinata var. languida grows 1) in open canopy woodlands dominated by ponderosa pine (Pinus ponderosa), 2) in bitterbrush (Purshia tridentata) communities, 3) in

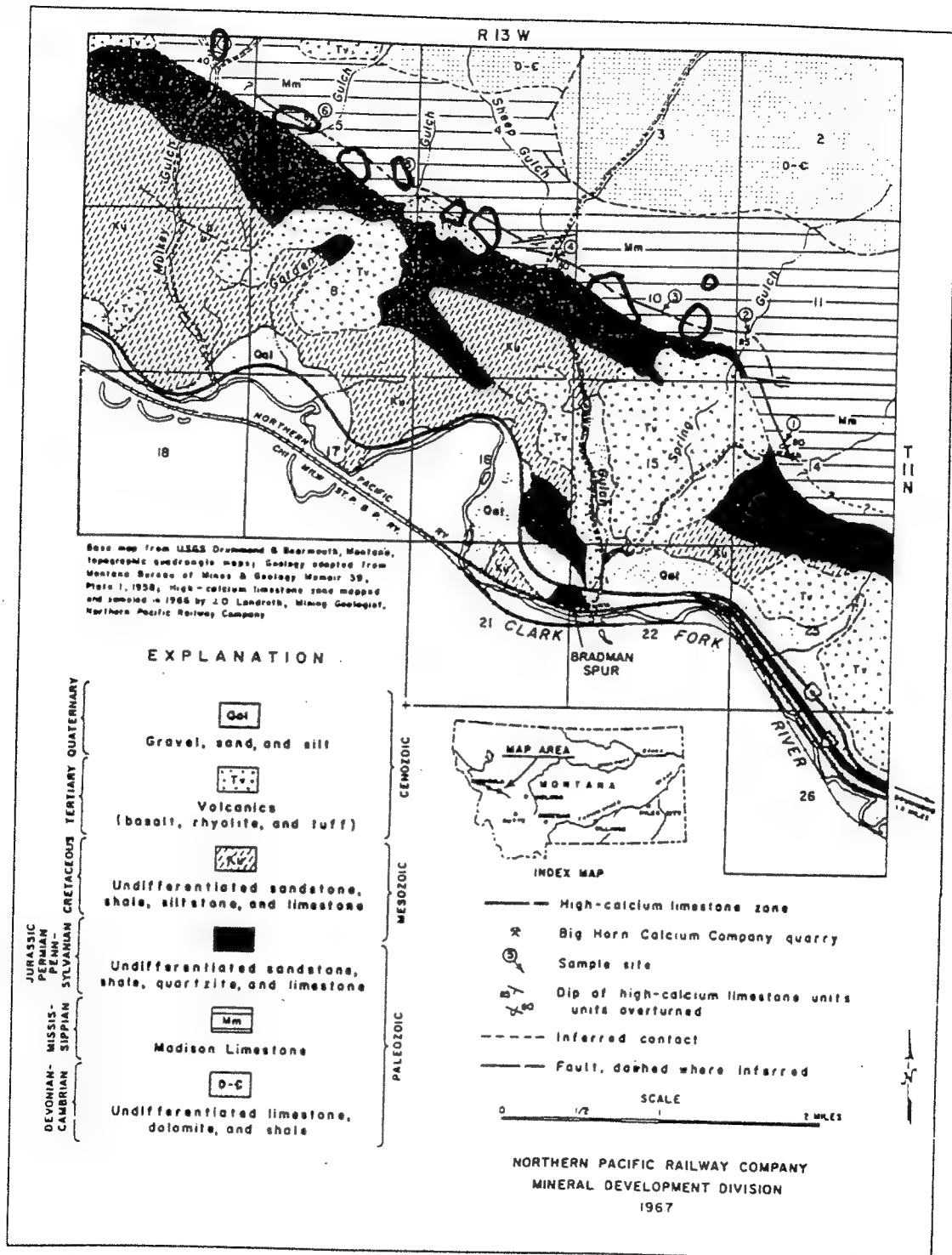


Figure 4. Geologic map of the Rattler Gulch Area, Granite County Montana, showing zone of high calcium limestone (Landreth 1968), with Rattler Gulch (003) subpopulations of *Lesquerella carinata* var. *languida* superimposed. Modified after Schassberger 1991.

grasslands, 4) on rocky slopes and outcrops, and 5) in ecotones of these habitats. The woodland communities most closely resemble the Elymus spicatus (bluebunch wheatgrass) phase of the Pinus ponderosa/Purshia tridentata habitat type and "forested scree" communities described by Pfister et al. (1977). The shrublands key to the Purshia tridentata/Elymus spicatus and Purshia tridentata/Festuca scabrella (rough fescue) habitat types of Mueggler and Stewart (1980). The Bear Creek Cliffs (004) site was reported as a Festuca idahoensis (Idaho fescue)/Elymus spicatus habitat type. The vegetation community structure in the population areas is usually a patchy mosaic of open forest, shrubland, grassland, and barren slopes and outcrops, with Lesquerella carinata var. languida commonly occurring in the more open microhabitats.

2. **Regional vegetation types:** The Garnet Mountains are included in the Bitterroot Valley Section of the Middle Rocky Mountain Steppe-Coniferous Forest-Alpine Meadow Province (USDA Forest Service 1994b). This mountainous "ecoregion" is characterized by elevational zonation of vegetation. All populations of Lesquerella carinata var. languida occur in a relatively low elevation zone dominated by grasslands, shrublands, and ponderosa pine forest. The sites are close to the upper boundary of the foothills prairie and the lower boundary of the western ponderosa forest, potential natural vegetation types mapped by K  chler (in USDA Forest Service 1979); the higher elevations of the Garnet Range are mapped as douglas fir forest.
3. **Frequently associated species:** The following plants have been documented growing in association with Lesquerella carinata var. languida at one or more locations. Included are species listed by Schassberger (1991) and on Element Occurrence Records (Appendix A), as well as species noted by Vanderhorst in the field in 1994. Non-native species (Eurasian weeds) are designated by an asterisk (*) preceding the scientific name of the plant.

Achillea millefolium (yarrow)

Agoseris glauca (short beaked false dandelion)

*Alyssum alyssoides (pale alyssum)

- Arabis holboellii (Holboell's rockcress)
Arabis nuttallii (Nuttall's rockcress)
Artemisia frigida (fringed sagewort)
Astragalus miser (weedy milk-vetch)
Astragalus missouriensis (Missouri milk-vetch)
 *Bromus tectorum (cheatgrass)
 *Centaurea maculosa (spotted knapweed)
Chrysothamnus nauseosus (common rabbitbrush)
Collinsia parviflora (blue-eyed mary)
Comandra umbellata (bastard toad-flax)
Crepis occidentalis (western hawksbeard)
Cryptantha celosioides (northern miner's candle)
Delphinium bicolor (Montana larkspur)
Dodecatheon conjugens (slimpod shooting star)
Elymus spicatus (bluebunch wheatgrass)
Erigeron compositus (cut-leaf daisy)
Erysimum asperum (plains wallflower)
 *Euphorbia esula (leafy spurge)
Festuca idahoensis (Idaho fescue)
Festuca scabrella (rough fescue)
Gutierrezia sarothrae (broom snakeweed)
Haplopappus acaulis (stemless goldenweed)
Juniperus scopulorum (Rocky Mountain juniper)
Koeleria macrantha (prairie junegrass)
Lesquerella alpina (alpine bladderpod)
Linum lewisii (blue flax)
Lithospermum ruderae (puccoon)
Lomatium cous (Cous biscuit-root)
Lomatium triternatum (nine-leaf biscuit-root)
Mahonia repens (Oregon grape)
Penstemon albertinus (Alberta penstemon)
Penstemon eriantherus (fuzzytongue penstemon)
Phlox hoodii (Hood's phlox)
Phlox pulvinata (tufted phlox)
Pinus flexilis (limber pine)
Pinus ponderosa (ponderosa pine)
Poa secunda (Sandberg's bluegrass)
Prunus virginiana (chokecherry)
Pseudotsuga menziesii (Douglas fir)
Purshia tridentata (bitterbrush)
Senecio canus (wooly groundsel)
 *Verbascum thapsus (mullein)

4. **Dominance and frequency of the taxon:** In the nearly barren openings where it usually grows, Lesquerella carinata var. languida can be the most common plant, however, total coverage by the species remains quite low, estimated at less than 5% at the highest population densities, and usually much lower. In general, plants of the genus Lesquerella tend to grow

"contiguously," in populations which can have extensive "coverage of land" (Rollins and Shaw 1973).

5. **Successional phenomena:** Successional events are probably very slow at the severe sites where Lesquerella carinata var. languida grows. Comments by Pfister et al. (1977) concerning "forested scree" communities are germane; they considered these to be "topo-edaphic climaxes, where vegetation reaches a quasi-equilibrium with the constantly shifting substrate." Under natural conditions, appropriate habitat for Lesquerella carinata var. languida is likely to persist at any one site for a long period, or indefinitely, however, these open habitats (at least the understories) have many early successional attributes and are highly susceptible to invasions of exotic weeds.
 6. **Dependence on dynamic aspects of biotic associations and ecosystem features:** not known
 7. **Other endangered, threatened, rare, or vulnerable species occurring in habitat of this taxon:** none known
7. **Population biology of the taxon.**
- A. **General summary:** Lesquerella carinata var. languida is known from four populations clustered in a small area of the Garnet Range. Depending on the year, the total number of plants throughout the range is estimated to be in the thousands to hundreds of thousands. The total known population area is about 81 hectares (200 acres). Lesquerella carinata var. languida is a short-lived perennial which reproduces by seed, flowering in spring and producing fruit in early summer. The taxon is mostly outcrossing and is insect pollinated. There are no specialized seed dispersal mechanisms, and plants grow in a patchy spatial pattern sometimes at high local densities. Populations may undergo dramatic fluctuations in overall numbers and in numbers of births, deaths, and seeds produced; these cycles seem to track ~~random~~ fluctuations in the climate.
 - B. **Demography.**
 1. **Known populations:** There are now four occurrences of Lesquerella carinata var. languida entered in the Biological Conservation

Database maintained by the Montana Natural Heritage Program. This number has been in a state of flux due to the discoveries of subpopulations which link previously thought discrete populations (Schassberger 1991). Additional potential habitat which has not been surveyed may occur in areas between the currently recognized populations. The four populations may be better considered as one (or two) megapopulation(s) with numerous subpopulations, but this remains to be elucidated by field surveys. Demographic details for the four currently recognized populations are given below; Element Occurrence Records giving more complete information on the populations, and topographic maps showing their precise locations and boundaries are given in Appendix A.

2. General demographic details (Montana):

a. Bear Creek (001)

- 1. Area occupied by population:** 4 hectares (10 acres)
- 2. Estimated number of individuals:** about 1,000 plants (1994)
- 3. Density:** calculated as 0.025 plants per m² (0.003 plants per ft²), but in a patchy distribution with higher local densities
- 4. Presence of dispersed seeds:** mature fruit present, but not yet dehiscent
- 5. Evidence of reproduction:** mature fruit present
- 6. Evidence of population expansion or decline:** observed only in 1994

b. Rattler Gulch (003)

- 1. Area occupied by population:** 60 hectares (150 acres)
- 2. Estimated number of individuals:** Total > 100,000 (1990); total 10,000-100,000 (1994)

3. **Density:** The calculated density based on 100,000 individuals on 60 hectares (150 acres) is 0.17 plants per m^2 (.015 plants per ft^2). The highest local densities observed in 1994 were approximately 11 plants per m^2 (1 plant per ft^2).
4. **Presence of dispersed seeds:** General surveys were conducted in May and June when plants were flowering or with intact fruit. Establishment of seedlings was documented in transects in 1992 and 1993, and evidence of a seed bank was found in 1993 (Greenlee 1994).
5. **Evidence of reproduction:** Demographic monitoring transects were established in 1991 and annually monitored through 1993 (Greenlee 1994) at subpopulation sites at Rattler Gulch and Mulkey Gulch. Reproductive plants, fruit production, and establishment of seedlings were documented at both sites in all years.
6. **Evidence of population expansion or decline:** The total estimated numbers of the Rattler Gulch subpopulation declined in 1990, due to herbicide drift from adjacent private land (Schassberger 1991). Demographic monitoring (Greenlee 1994) indicated that the population was declining in 1991-1992 and growing in 1992-1993. The Rattler Gulch subpopulation had the most dramatic fluctuation in growth rate of three sites studied including the Mulkey Gulch subpopulation (included here in the Rattler Gulch population) and a subpopulation of the Felan and Packer Gulch population (005, see below). In 1994, a hot, dry year, much of the year's fruit was aborted, suggesting another potential decline.

b. Bear Creek Cliffs (004)

1. **Area occupied by population:**
Unknown.
2. **Estimated number of individuals:**
101-1,000 (1986); 20 plants relocated (1989).
3. **Density:** unknown
4. **Presence of dispersed seeds:** unknown
5. **Evidence of reproduction:** none reported
6. **Evidence of population expansion or decline:** Few plants relocated in 1989 may be evidence of decline or due to incomplete survey.

c. Felan and Packer Gulches (005)

1. **Area occupied by population:** 40 acres
2. **Estimated number of individuals:**
Total numbers are unavailable for subpopulations at Packer and Felan Gulches, however, as many as 950 plants were counted in a monitoring transect (Greenlee 1994), taken to represent just a small proportion of the total population area.
3. **Density:** not available
4. **Presence of dispersed seeds:** See below.
5. **Evidence of reproduction:**
Demographic monitoring transects were established on west facing slopes (Packer Gulch subpopulation) in 1991 and monitored through 1993, documenting birth of seedlings and fruit production (Greenlee 1994). The reproductive values at this subpopulation were higher than values for the Rattler Gulch population (Rattler Gulch and Mulkey Gulch subpopulations).

6. **Evidence of population expansion or decline:** In 1989, two large, vigorous subpopulations were observed. In 1990, the subpopulation at Packer Gulch was greatly reduced, and the subpopulation at Felan Gulch was slightly reduced. Based on demographic monitoring (Greenlee 1994), the Packer Gulch subpopulation was declining from 1991 to 1992, and increasing from 1992 to 1993, however, population growth rate was more stable at this site than at Rattler or Mulkey Gulches.

C. Phenology.

1. **Patterns:** Most flowering occurs in April through June and mature fruit are produced in May through July (Greenlee 1994, Schassberger 1991).
2. **Relation to climate and microclimate:** Date of flowering and fruit maturation are affected by elevation and microsite. On slopes east of Rattler Gulch, on May 31, 1994, most plants were finished flowering and had mature fruit, however, flowering plants with immature fruit were observed in shaded microsites and at the highest elevation (1,707 meters or 5,600 ft.) of the site.

D. Reproductive ecology.

1. **Types of reproduction:** Reproduction is believed to be entirely by seed. Vegetative reproduction has not been observed (Greenlee 1994).
2. **Pollination.**
 - a. **Mechanisms:** Lesquerella carinata var. languida is insect pollinated and primarily outcrossing, although selfing has been detected (Greenlee 1994). Outcrossing species are more likely to be pollinator-limited than selfing species. However, reproduction of Lesquerella gordonii, a self incompatible, spring flowering, desert annual, was found to be more limited by water availability than by pollination (Delph 1986).

- b. **Specific known pollinators:** bees and flies (Greenlee 1994)
- c. **Other suspected pollinators:** other insects, possible unfacilitated selfing
- d. **Vulnerability of pollinators:** Pollinators may be vulnerable to pesticides and climatic fluctuations, however, the general nature of reported pollinators may imply some resistance to these threats.

3. Seed dispersal.

- a. **General mechanisms:** No specialized seed dispersal mechanisms are known (Greenlee 1994). It is likely that most seeds fall to the ground and germinate in the vicinity of the mother plant or are transported short distances by gravity, surface disturbance or water flow.
- b. **Specific agents:** gravity, water, surface disturbance
- c. **Vulnerability of dispersal agents and mechanisms:** not applicable
- d. **Patterns of propagule dispersal:** It is likely that most seeds are not dispersed very far from the mother plant. The extremely localized range of Lesquerella carinata var. languida and the patchy distribution of plants within population areas supports this assumption.

4. Seed biology.

- a. **Amount and variation of seed production:** Greenlee (1994) calculated a fecundity estimate of 1.53-2.13 seeds/fruit and estimated that 26 fruiting plants produced an estimated 104-145 seeds in monitoring transects at Rattler Gulch in 1992. Herbarium specimens collected by the author in 1994 have between 4 and 47 fruits/plant. The proportion of reproductive plants varies between sites and years with the highest fluctuation (ranging from > 60% in 1991 to < 20% in 1993) occurring at the hot, dry Rattler Gulch site (Greenlee 1994).

- b. **Seed viability and longevity:** This is not known, however, Greenlee (1994) found evidence of a seed bank in monitoring transects at Rattler Gulch. In 1993, over twice as many seedlings were born in the plots as the number of seeds calculated produced in the plots in 1992 (see a. above).
 - c. **Dormancy requirements:** Seeds require stratification to germinate; storage for one month at 1-2° C is favorable for germination in the greenhouse (Greenlee 1994). Scarification also enhances germination (Greenlee 1994), indication of seed coat dormancy.
 - d. **Germination requirements:** Germination rates were higher when seeds were planted in a standard greenhouse potting soil compared to soil from the Packer Gulch population; both under a 17 hour light/ 7 hour dark cycle at 12-18 degrees C (55-65 degrees F) (Greenlee, pers. commun.).
 - e. **Percent germination:** Only 8.5% of the seeds planted in experimental plots in native habitat at Rattler Gulch germinated in 1993, a wet year (Greenlee 1994). Greenhouse germination rates were between 2- - 80% (Greenlee, pers. commun.).
5. **Seedling ecology:** Seeds germinate in early spring (Greenlee 1994). The birth and survival of seedlings can vary between years and sites (Greenlee 1994). In 1992, a hot, dry year, there were few seedlings in monitoring transects, while in 1993, a cool, wet year, there were many. This fluctuation was greatest at Rattler Gulch, a hot, dry site, and least at Bear Creek (Packer Gulch subpopulation), a more mesic site. Survivorship of seedlings also seems to reflect climatic fluctuations. Seedling survival in plots at Rattler Gulch was very high (83%) in 1993, but in 1994, another dry year, seedling survival in the same plots ranged from 0 in the open, to less than 20% under a bunchgrass canopy (Greenlee and Callaway, in progress). Seedling survival in 1994 at the more mesic Bear Creek site was higher than at Rattler Gulch, ranging from around 20% for open and clipped bunchgrass

treatments to 60-70% for bunchgrass and shade treatments. Lesquerella carinata var. languida seems to use bunchgrasses as nurse plants in stressful years, but not in other years (Greenlee, pers. commun., see I.8.B. and C. below).

6. **Survival and mortality:** Mortality rates ranged from around 0.2 to over 0.7 in monitoring transects (Greenlee 1994). As with seedling survival discussed above, deaths of adult plants and population mortality rates mirrored climatic fluctuations at Mulkey and Rattler Gulches (high mortality in dry year) but there was little fluctuation at the more mesic Bear Creek site. Adult survivorship was determined to be the life cycle component most critical to population growth and viability (Greenlee 1994). In experimental plots, survivorship of adult Lesquerella carinata var. languida was increased by knapweed removal (Greenlee 1994, see I.8.C. below).

7. **Overall assessment of taxon's reproductive success:** Populations of Lesquerella carinata var. languida are capable of high levels of reproduction but may also be subject to high mortality. The populations may go through boom/bust cycles, with high seedling establishment, low mortality, and high population growth rates in favorable (i.e. wet) years, but few seedlings, high mortality, and population decline in stressful (i.e. dry) years (Greenlee 1994).

8. Population ecology of the taxon.

- A. **General summary:** Lesquerella carinata var. languida usually grows in open microhabitats and within its niche may be the most common plant, thus intraspecific interactions probably play an important role in the population ecology of the taxon. However, at extremely hot, dry sites, Lesquerella carinata var. languida has a positive association with bunchgrasses, which can act as nurse plants for seedlings. At more mesic sites, Lesquerella carinata var. languida is not positively associated with bunchgrasses. The primary threat to populations is invasion by spotted knapweed (Centaurea maculosa), which has been shown to negatively impact Lesquerella carinata var. languida growth and survival (Greenlee 1994).

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- B. Positive and neutral interactions:** Adult and seedling plants of Lesquerella carinata var. languida were found to have a positive spatial relationship with bunchgrasses at the relatively hot, dry Rattler Gulch site (Greenlee 1994). This relationship was explained by data collected from Rattler Gulch and Bear Gulch in 1994, a hot, dry (i.e. high stress) year; seedlings planted near bunchgrasses had higher survivorship and root and shoot biomass than those planted in the open (Greenlee and Callaway, in progress). Lesquerella carinata var. languida seems to use bunchgrasses as nurse plants in stressful years, but not in less stressful years (Greenlee, pers. commun.), resulting in a positive spatial association at severe sites, where there is a high frequency of stressful years.
- C. Negative interactions.**
1. **Herbivores, predators, pests, parasites and diseases:** none known
 2. **Competition.**
 - a. **Intraspecific:** No studies of intraspecific competition have been conducted. Lesquerella carinata var. languida generally grows in open habitats and is often the most common plant in its niche. Intraspecific competition, especially for water, is likely to play a major role in its population biology.
 - b. **Interspecific:** Greenlee (1994) showed that spotted knapweed (Centaurea maculosa) interferes with growth and survival of Lesquerella carinata var. languida. Removal of knapweed from experimental plots increased Lesquerella vigor (rosette diameter, leaf width and length), and most importantly, adult survivorship. Spotted knapweed has been shown to be capable of invading undisturbed native grasslands in Montana (Tyser and Key 1988). The open habitats with a natural disturbance regime where Lesquerella carinata var. languida grows may be especially vulnerable to these invasions.

In contrast to the bunchgrass facilitation patterns found at the hot, dry Rattler Gulch site (see I.8.B. above), Lesquerella

carinata var. languida was found to have a negative spatial relationship with bunchgrasses at a more mesic site in the drainage of Bear Creek (Greenlee 1994). Lesquerella seedling survivorship and root and shoot biomass were lower near bunchgrasses than in the open during the cool, wet (i.e. low stress) summer of 1993 at both Rattler and Bear Gulches (Greenlee 1994, Greenlee and Callaway, in progress).

3. Toxic and allelopathic interactions: not known

D. Hybridization.

1. Naturally occurring: None reported for this or other closely related species of Lesquerella.
2. Artificially induced: none reported
3. Potential in cultivation: Natural and artificial hybridization has been reported between members of a group of Lesquerella species which occupy floodplain habitats in Tennessee (Rollins and Shaw 1973). These species were allopatric until agricultural activities brought them together and no genetic fertility barriers had developed. It is possible that other allopatric species of Lesquerella are also capable of interspecific hybridization.

E. Other factors of population ecology: none reported

9. Current land ownership and management responsibility.

A. General nature of ownership: The south front of the Garnet Mountains where Lesquerella carinata var. languida is found has a complex checkerboard pattern of ownership by the Bureau of Land Management, State of Montana, timber companies, and other private entities (U.S. Department of Interior 1986).

B. Specific landowners (Montana):

1. U.S. Department of the Interior
Bureau of Land Management
Garnet Resource Area
3255 Fort Missoula Road
Missoula, Montana 59801

2. Champion International Corporation
 3. Plum Creek Timber Company Inc.
 4. Other private owners
- C. **Management responsibility:** as outlined under specific landowners
- D. **Easements, conservation restrictions, etc.:** There is currently a BLM Area of Critical Environmental Concern (ACEC) in Rattler Gulch which protects the Madison limestone formations in the canyon, but does not extend to the hillside habitat where Lesquerella carinata var. languida grows.
10. **Management practices and experience.**
- A. **Habitat management.**
1. **Review of past management and land use experiences.**
 - a. **This taxon:** Damage to the Rattler Gulch population was caused by aerial spraying of the herbicide "Tordon" (picloram) on nearby private lands (Schassberger 1991, Achuff and Schassberger 1992). Tordon is commonly used to control spotted knapweed in Montana.* Spotted knapweed has been identified as the primary threat to populations of Lesquerella carinata var. languida (Greenlee 1994), and a management program for this noxious weed is urgently needed. However, herbicides pose their own threat to the rare plant. In experimental plots in western Montana rangeland, Tordon was shown to be a more effective long term control for knapweed, but resulted in lower plant diversity compared to other herbicides ("Stinger" and "Curtail") tested (Rice et al. 1992). The effects of different herbicides on Lesquerella carinata var. languida has not been researched. Schassberger (1991) also reported loss of plants of Lesquerella carinata var. languida caused by cattle trampling. Cattle grazing is the primary commercial land use in the area, though cattle are mostly confined to the lower slopes of the habitat areas.

b. **Related taxa:** The Deerlodge National Forest has had some experience managing for the conservation of Lesquerella paysonii at Emerine Gulch in southern Granite County (John Joy, pers. commun.). This population is also threatened by invasion of spotted knapweed. A hand removal program was attempted, but was found to be counter-productive due to the surface disturbance which was caused and the impossibility of completely removing all knapweed. Subsequently, the herbicide "Stinger" (clopyralid) has been successfully employed to manage knapweed in the population area without harming Lesquerella paysonii (John Joy, pers. commun.). Stinger has been shown to effectively control knapweed in western Montana rangelands while preserving or enhancing species diversity, including that of forbs (Rice et al. 1992). The effects of Stinger on Lesquerella carinata var. languida are not known.

c. **Other ecologically similar taxa:** not reviewed

2. **Performance under changed conditions:** Spotted knapweed has been shown to negatively impact growth and survival of Lesquerella carinata var. languida (Greenlee 1994, see I.8.C.2.b. in this status review). In 1994, the author of this review found few plants of Lesquerella carinata var. languida in areas of potential habitat with heavy infestations of spotted knapweed, and these were generally smaller and more scattered than in adjacent areas without knapweed. This is evidence of knapweed's invasion of Lesquerella carinata var. languida populations and their resulting decline.

3. **Current management policies and actions:** Lesquerella carinata var. languida is currently proposed by the Bureau of Land Management for sensitive status in Montana (USDI Bureau of Land Management 1993), though no management policy or plan is in place for the species.

4. **Future land use:** Potential future land use in the vicinity of the Lesquerella carinata var. languida populations includes cattle grazing, limestone quarrying, and logging. All of these

activities may adversely affect populations of the rare plant, primarily by causing disturbances and introducing weed seeds, thus accelerating weed invasions.

B. Cultivation.

1. **Controlled propagation techniques:** Seeds have been germinated under greenhouse conditions (Greenlee 1994).
2. **Ease of transplanting:** Greenlee (1994) planted seeds of Lesquerella carinata var. languida in experimental plots in native habitat, and although germination was low, some seedlings survived. In a hot, dry year (1994), seedling success was increased by planting under bunchgrass canopies and shade cloth, compared to planting in the open or near clipped bunchgrass (Greenlee and Callaway, in progress). These results may have applications if reintroductions of Lesquerella carinata var. languida are attempted in the future (Greenlee, pers. commun.). Propagation techniques other than seeding are unlikely to be successful given the plant's morphology and the severe environment where it grows.
3. **Pertinent horticultural knowledge:** See section I.7.D.4.c. for requirements for breaking seed dormancy.
4. **Status and location of presently cultivated material:**
 - a. **Specimen plants:** Several Lesquerella carinata var. languida grow in the native plant garden around the Botany greenhouse at the University of Montana. These were grown from seed in the greenhouse (greenlee, pers. commun.). The garden is maintained by the Montana Native Plant Society.
 - b. **Self-sustaining breeding populations:** none known
 - c. **Stored seed:** none known

11. Evidence of threats to survival.

- A. **Present or threatened destruction, modification, or curtailment of habitat or range:** The primary threat to Lesquerella carinata var. languida is curtailment of its habitat and range caused by the invasion of noxious weeds, especially spotted knapweed (Centaurea maculosa). Spotted knapweed has been documented at all known population sites and the invasion is known to be intense and extensive in three populations including Bear Creek (001), Rattler Gulch (003), and Felan and Packer Gulches (005). The weed is invading the Lesquerella carinata var. languida populations primarily from downslope, where it occurs as a dominant or in a monoculture, often on privately owned rangeland; but small patches were seen high up the slopes at Rattler Gulch (003). Knapweed has been shown to be capable of invading undisturbed native Montana grasslands (Tyser and Key 1988), and the arid, open habitats where Lesquerella carinata var. languida grows may be especially vulnerable to invasions of the weed. Spotted knapweed has been shown to impede growth and survival of Lesquerella carinata var. languida (Greenlee 1994). Other exotic species documented in the population areas which pose similar threats include cheatgrass (Bromus tectorum) and leafy spurge (Euphorbia esula).

Lesquerella carinata var. languida may have had its local range curtailed in the past by mining activity (Schassberger 1991). The Rattler Gulch population (003) occurs on a band of high calcium limestone which has been identified to be of commercial quality (Landreth 1968). In the past there was a limestone quarry in Rattler Gulch (Landreth 1968), and currently a quarry is operated in Spring Gulch just to the north. Private and BLM land around the quarry has not yet been surveyed for Lesquerella carinata var. languida. The quarries are located in the canyons, and do not appear to extend to the south-facing slopes where Lesquerella carinata var. languida is found. However, future expansion of the quarry in Spring Gulch (the Rattler Gulch quarry is included in a BLM ACEC) or development of new quarries could significantly reduce population areas of Lesquerella carinata var. languida. Disturbance associated with mining may also result in the spread of spotted knapweed and other weeds.

- B. **Overutilization for commercial, sporting, scientific, or educational purposes:** Lesquerella carinata var. languida has not been utilized for commercial, sporting, or educational purposes. The taxon is represented by a relatively large number of herbarium specimens considering its limited distribution. These collections have been instrumental in the description of the variety and documentation of its distribution. Collection for scientific purposes has probably had little impact on population numbers, especially when compared with the curtailment of habitat discussed above. However, scientific activity may threaten populations by disturbing the surface substrate and introducing plant species not native to the local site.
- C. **Disease, predation, or grazing:** No diseases or herbivory have been reported, and the low, prostrate habit of Lesquerella carinata var. languida constrains potential grazing. However, loss of plants by trampling was observed at Rattler Gulch (Schassberger 1991), and cattle grazing has been identified as a threat to populations (Greenlee 1994, Schassberger 1991). A subpopulation area of the Rattler Gulch population (003) is heavily terraced by cattle trails and this area is also heavily infested with knapweed. Cattle are most likely to threaten populations of Lesquerella carinata var. languida by transporting seeds of exotic plants and creating disturbances which are ideal for weed establishment.
- D. **Inadequacy of existing regulatory mechanisms:** There is no current mandate to establish an interagency integrated weed management program for spotted knapweed in the population areas.
- E. **Other natural or man-made factors:** Weed control practices may also threaten populations of Lesquerella carinata var. languida. Schassberger (1991) reported herbicide damage to the Rattler Gulch population caused by aerial spraying of Tordon on nearby private lands.

II. ASSESSMENT AND RECOMMENDATIONS

12. **General assessment of vigor, trends, and status:** Lesquerella carinata var. languida is confined to a very small area of edaphically and ecologically specific habitat. Its populations are sometimes large but may undergo drastic fluctuations in numbers. These

fluctuations seem to be tied to climatic cycles and long term population trends are not known. However, it is highly likely that the population areas of Lesquerella carinata var. languida have been significantly reduced, and total population size significantly impacted by recent invasions of spotted knapweed (Centaurea maculosa) and possibly other weeds. It is also likely that the spread of knapweed will continue in the population areas unless preventative actions are taken.

13. Recommendations for listing or status change.

- A. Recommendation to U.S. Fish and Wildlife Service:**
On the basis of the information summarized in this report, it is recommended that the status of Lesquerella carinata var. languida be changed to Category 1. All known populations of the plant are currently threatened by invasion of spotted knapweed. Although limestone habitats throughout Granite County have been intensely searched, Lesquerella carinata var. languida has not been found except in the restricted area reported here. Its susceptibility to dramatic population fluctuations and the current curtailment of its habitat indicate that Lesquerella carinata var. languida is vulnerable to irreversible declines in population area and numbers. Conservation management for this plant is urgently needed, and designation of U.S. Fish and Wildlife Service Category 1 status will create a mandate for this action.

It is possible that the species Lesquerella carinata as a whole, which is currently listed as Category 2, would again be put in Category 3C. It is not the purpose of this status review to evaluate the entire species. It is recommended that both varieties of Lesquerella carinata be considered separately by the Fish and Wildlife Service in keeping with the current taxonomic treatment (Rollins 1993). Recommendations on Lesquerella carinata var. languida should not be taken to be applicable to Lesquerella carinata var. carinata, and vice-versa. These two varieties are separated by great distances and by correlated differences in morphology and habitat.

- B. Recommendations to other U.S. federal agencies:**
Lesquerella carinata var. languida should be designated Sensitive in Montana, as proposed, by the BLM (USDI Bureau of Land Management 1993). However, it should be deleted from the list of U.S. Forest

Service Region 1 Sensitive plants (USDA Forest Service 1994) because it is not known to occur on a National Forest. The previously reported occurrence of Lesquerella carinata at Emerine Gulch on the Deerlodge National Forest was redetermined by R. C. Rollins in 1990 to be Lesquerella paysonii (see I.5.B.6.). This is the only known occurrence of this species in Montana despite Rollins characterization of its range as including "western Montana" (Rollins 1993). Lesquerella paysonii should be designated Sensitive by Region 1 in place of Lesquerella carinata var. languida.

C. Other status recommendations.

1. **Counties and local areas:** Lesquerella carinata var. languida should be recognized as a Granite County endemic and its conservation status and needs should be brought to the attention of the County weed board and the Montana Department of Agriculture.
 2. **States:** The current global rank (G2T1) and state rank (S1) designated by the Montana Natural Heritage Program remain appropriate.
 3. **Other nations:** none
 4. **International:** none
14. **Recommended critical habitat:** Because Lesquerella carinata var. languida is confined to an extremely small area, all of its population areas, as outlined above (I.B.1.) and mapped in Figure 3 and Appendix A, are recommended for designation as critical habitat. The total area presently known is about 200 acres. Designation of critical habitat on private property does not affect private property rights except insofar as federal funds are involved. Other potential habitat in the immediate area should also be considered critical until the absence of Lesquerella carinata var. languida is documented (see I.5.B.4.). Ecological diversity within the population areas is important for maintaining adequate plant numbers in climatically extreme years. Protection of relatively pristine habitat (usually upper slope positions) is especially important because these areas may serve as a reservoir for recolonization of previous habitat when and if spotted knapweed is controlled on the lower slopes.

15. Conservation/recovery recommendations.

A. General conservation recommendations.

1. **Recommendations regarding present or anticipated activities:** At present, the land of the population areas is used for cattle grazing and for game habitat. Because cattle may serve as vectors for spotted knapweed, and create disturbances favorable for this weed, they should be fenced out of areas which support populations of Lesquerella carinata var. languida. The primary use of the population areas is by wild game, and this use is likely to continue barring declines in game populations. Bitterbrush, a nearly constant associate of Lesquerella carinata var. languida, is a desirable forage for big game (Muegler and Stewart 1980, Pfister et al. 1977). The only recommendation concerning game management in the area is that fencing be used to minimize animal traffic between population areas and areas with heavy infestations of knapweed (management for knapweed is discussed below).

Commercial activities which could potentially affect populations of Lesquerella carinata var. languida in the future include mining and logging. Expansion of quarries or development of new quarries on the high calcium limestone zone which Lesquerella carinata var. languida occupies would directly impact the population areas and numbers. Although the forest habitat types in the population areas are considered to have low timber productivity (Pfister et al. 1977), logging may be considered in the future; in 1994, selective helicopter logging of similar habitats was observed nearby. Like other activities, logging would be expected to cause surface disturbances and encourage spread of knapweed and other weeds, and canopy removal could influence the microclimate for Lesquerella carinata var. languida and thus impact population viability.

2. **Areas recommended for protection:** These areas are outlined under "critical habitat" above (II.14.). Relatively large population areas occur on Bureau of Land Management (BLM) lands. These are to the east of Rattler Gulch (T11N R13W S10), and in the vicinities of Mulkey

Gulch (T11N R13W S5, S6 and T12N R13W S32) and Bear Gulch (T12N R14W S33, S34 and T11N R14W S3). Subpopulations of Lesquerella carinata var. languida and BLM land ownership is shown in Figure 2 (also see the topographic maps in Appendix A).

3. **Habitat management recommendations:** The most significant threat to Lesquerella carinata var. languida is invasion of its habitat by spotted knapweed (Centaurea maculosa). An integrated weed management program is urgently needed. This will require cooperation between federal and county agencies and private landowners. Judicious herbicide use is recommended for controlling monocultures of spotted knapweed which often predominate, usually on private land, downslope from the Lesquerella carinata var. languida populations. However, care should be taken that herbicide drift absolutely does not impact populations of the rare plant. Herbicides which are selective for spotted knapweed and do not harm Lesquerella carinata var. languida may be available. Biological controls will probably be the best future long term management tools for fighting spotted knapweed in natural areas and rangelands in western Montana. The southern flank of the Garnet Mountains between Drummond and Nimrod should be considered as a priority location for the release and establishment of spotted knapweed biological control agents, such as the root boring moth, Agopeta zoezana (Story 1989). Cultural controls such as fencing to keep out cattle and direct game migration patterns, and minimizing human activities in the population areas hold the most immediate promise for curbing knapweed invasions in the population areas. Well intended but ineffective hand removal of spotted knapweed would probably cause more damage than good on the fragile slopes where Lesquerella carinata var. languida grows.
4. **Publicity sensitivity:** Conservation management for Lesquerella carinata var. languida will require cooperation between private citizens and federal and local agencies, thus open communication between these parties will be essential. There is a great potential for consensus in this issue, because the noxious spotted knapweed is already perceived as a

threat by ranchers, the general public, and the agencies. However, there is potential for this issue to become politically sensitive, and actions should be planned and publicity handled to avoid this.

5. Other recommendations: none

- B. Monitoring activities and research needs:** Although human activity should be minimized in the population areas, there is need for further surveys and research, and these should be pursued. Some potential habitat for Lesquerella carinata var. languida in the immediate area of the known populations, especially between the populations, remains to be surveyed (see I.5.B.4.). Surveys should also be conducted to locate large populations of spotted knapweed to prioritize weed control efforts. Populations of both Lesquerella carinata var. languida and spotted knapweed should be monitored so that long term trends in numbers and areal coverage can be detected and the success of conservation management can be evaluated. The sensitivity of Lesquerella carinata var. languida to "gentle" herbicides such as Stinger requires research. Collection of data on the microclimate of the population areas could be used for predicting trends and better understanding the ecology of Lesquerella carinata var. languida as monitored elsewhere by the BLM (Greenlee, pers. commun.).

16. Interested parties:

Office of Endangered Species
ATTN: Dr. James Miller
U.S. Fish and Wildlife Service
P.O. Box 25486
Denver Federal Center
Denver, CO 80225

U.S. Fish and Wildlife Service
ATTN: Lori Nordstrom
Federal Building, 301 S. Park
P.O. Box 10023
Helena, MT 59626

Office of Endangered Species
ATTN: Dr. John Fay
U.S. Fish and Wildlife Service
Washington, D.C. 20240

U.S. Bureau of Land Management
ATTN: Don Heinze
P.O. Box 36800
Billings, MT 59107-6800

U.S. Forest Service - Deerlodge National Forest
ATTN: John Joy
P.O. Box F
Whitehall, MT 59759

U.S. Forest Service, Region One
ATTN: Steve Shelly
Federal Building
P.O. Box 7669
Missoula, MT 59807

The Nature Conservancy
ATTN: Dr. Larry Morse
1815 North Lynn Street
Arlington, VA 22209

The Nature Conservancy
ATTN: Bernie Hall
Montana Field Office
32 South Ewing
Helena, MT 59601

Lisa Schassberger Roe
531 Spencer
Helena, MT 59601

Jack Greenlee
Department of Botany and Plant Pathology
Oregon State University
Corvallis, OR 97331

Dr. Thomas Mitchell-Olds
Division of Biological Sciences
University of Montana
Missoula, MT 59812

Montana Natural Heritage
ATTN: Bonnie Heidel
State Library Building
1515 E. 6th Ave.
Helena, MT 59620

III. INFORMATION SOURCES

17. Sources of Information.

A. Publications.

1. **References cited in report:** See Literature Cited (pp. 43).

2. **Other publications/sources:** none

B. **Museum collections:** Specimens are deposited at Gray Herbarium (GH) and at the University of Montana (MONTU). The following list of known herbarium specimens is organized by occurrence number:

1. **Bear Creek (001):** Vanderhorst 5173 at MONTU

2. **Rattler Gulch (003):** Lackschewitz 7172, 7373, Lesica 2935, Schassberger 260, and Vanderhorst 5171, 5172 at MONTU; Schassberger 364, 366 at GH.

3. **Bear Creek Cliffs (004):** Lesica 3697 at MONTU.

4. **Packer and Felan Gulch (005):** Schassberger 262, 263 at MONTU; Schassberger 365, 366 at GH.

C. Fieldwork.

1. Surveys conducted:

a. Lisa Schassberger, May 31-June 2, 1989, June 11-15, 1990.

b. Jack Greenlee, 1991-1993.

c. Jim Vanderhorst, May 31-June 3, 1994.

D. Knowledgeable individuals:

Lisa Schassberger Roe
531 Spencer
Helena, MT 59601

Jack Greenlee
Department of Botany and Plant Pathology
Oregon State University
Corvallis, OR 97331

Dr. Reed C. Rollins
 Harvard Herbarium
 22 Divinity Avenue
 Cambridge, Massachusetts 02138

John Joy
 Deerlodge National Forest
 Jefferson Ranger District
 403 W. Legion, P.O. Box F
 Whitehall, Montana 59759

E. **Other information sources:** Element Occurrence
 Records and maps (reproduced in Appendix A) supplied
 by the Montana Natural Heritage Program.

18. **Summary of materials on file:** Files kept by the Montana Natural Heritage Program include copies of field survey forms, maps showing population locations and boundaries, maps showing sites which were searched but where Lesquerella carinata var. languida was not found, copies of all Heritage Program reports, reprints of many of the articles cited in this report, and slides.

IV. AUTHORSHIP

19. **Initial authorship:** Jim Vanderhorst
 Montana Natural Heritage Program
 State Library Building
 1515 East Sixth Avenue
 Helena, Montana 59620

20. **Maintenance of status report:**

Montana Natural Heritage Program
 address as above

V. NEW INFORMATION

21. **Record of revisions:** not applicable

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- _____. 1994. Montana plant species of special concern. Unpublished list. Montana Natural Heritage Program, Helena, MT. 16 pp.
- Heidel, B. L. and J. M. Poole. 1993. Montana plant species of special concern. Unpublished list. Montana Natural Heritage Program, Helena, MT.
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- Kauffman, M. E. 1963. Geology of the Garnet-Bearmouth area, western Montana. Memoir 39. Montana Bureau of Mines and Geology, Butte. 40 pp.
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- Lesica, P. and J. S. Shelly. 1991. Sensitive, threatened and endangered vascular plants of Montana. Occasional Publication no. 1. Montana Natural Heritage Program, Helena. 88 pp.
- Mueggler, W. F. and W. L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. General Technical Report INT-66. USDA Forest Service Intermountain Research Station, Ogden, UT.
- Pfister, R. D., B. L. Kovalchik, S. F. Arno, and R. C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. USDA Forest Service Intermountain Experiment Station, Ogden UT. 174 pp. plus attachments.
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- Rollins, R. C. 1973. The genus Lesquerella (Cruciferae) in North America. Harvard University Press, Cambridge, MA. 288 pp.
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- Trewartha, G. T. and L. H. Horn. 1980. An introduction to climate, 5th edition. McGraw-Hill Book Co., New York. 416 pp.
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- _____. 1989. Missoula East (Montana) 1:100,000-scale metric topographic map, BLM edition, surface management status. Billings, MT.
- _____. 1993. Draft list of sensitive and watch plant species in Montana. Unpublished list. Billings, MT. 1 p.
- U. S. D. I. Fish and Wildlife Service. 1980. Endangered and threatened wildlife and plants: review of plant taxa for listing as endangered or threatened species. Federal Register 45 (242): 82480-82569.
- _____. 1985. Endangered and threatened wildlife and plants: review of plant taxa for listing as endangered or threatened species; notice of review. Federal Register 50 (35): 39525-39584.
- _____. 1993. Plant taxa for listing as endangered or threatened species; notice of review. Federal Register 58 (188): 51144-51190.
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APPENDIX A. Element Occurrence Records (EORs) and topographic maps showing the precise locations of known populations of Lesquerella carinata var. languida.

MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Scientific Name: LESQUERELLA CARINATA VAR LANGUIDA
Common Name: KEELED BLADDERPOD

Global rank: G2T1 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Element occurrence code: PDBRA1NOB1.001
Element occurrence type:

Survey site name: BEAR CREEK
EO rank: C
EO rank comments: SMALL PLANTS, VERY HOT, DRY SITE, KNAPWEED
BECOMING DOMINANT.

County: GRANITE

USGS quadrangle: ELEVATION MOUNTAIN

Township: Range: Section: TRS comments:
012N 014W 34 NW4

Precision: S
Survey date: 1994-06-03 Elevation: 4250 - 4750
First observation: 1994-06-03 Slope/aspect: 20-40% / SOUTH
Last observation: 1994-06-03 Size (acres): 10

Location:
FROM BEARMOUTH ON I-90, TRAVEL CA. 3 MILES UP BEAR CREEK. POPULATION
IS ABOVE CABIN EAST OF ROAD ON SOUTH-FACING SLOPES ABOVE UNNAMED
GULCH.

Element occurrence data:
1000+ ESTIMATED PLANTS WITH 2 SUBPOPULATIONS. 10% FLOWERING, 80%
FRUITING, 10% VEGETATIVE. NO SEEDLINGS SEEN.

General site description:
DRY, OPEN, LOWERSLOPE TO MIDSLOPE. GRAVELLY CLAY; LIMESTONE PARENT
MATERIAL. ASSOCIATED SPECIES: JUNIPER SCOPULORUM, ELYMUS SPICATUS,
PRUNUS VIRGINIANA, ARTEMISIA FRIGIDA, CENTAUREA MACULOSA.

Land owner/manager:
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:
OBSERVED BY JIM VANDERHORST. CLOSE TO PACKER/FELAN GULCH POPULATIONS;
MAY POSSIBLY BE A SUBPOPULATION.

Information source: VANDERHORST, J. [BOTANIST]. 1515 LAKE STREET,
OGDEN, UTAH 84401.

Specimens: VANDERHORST, J. (5173). 1993. MONT.

Lesquerella carinata var. languida: Bear Creek (001)
USGS Elevation Mountain and Bearmouth 7.5' quads

MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Scientific Name: LESQUERELLA CARINATA VAR LANGUIDA
Common Name: KEELED BLADDERPOD

Global rank: G2T1 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Element occurrence code: PDBRA1N0B1.003
Element occurrence type:

Survey site name: RATTLER GULCH
EO rank: B
EO rank comments: VERY EXTENSIVE POPULATION COVERING A LARGE AREA.
KNAPWEED INVASION IS EXTENSIVE; AREA HEAVILY
TERRACED BY GRAZING.

County: GRANITE

USGS quadrangle: DRUMMOND
BEARMOUTH

Township:	Range:	Section:	TRS comments:
011N	013W	09	9 NW4, NE4SE4, 4 SE4SW4, SW4SW4, NE4,
012N	013W	31	5 SE4, SE4NW4, SW4NW4, 6 NE4SE4, NE4NE4, 10 W2, E2; T12N R13W 31 SE4SE4

Precision:	S	
Survey date:	1990-06-12	Elevation: 4400-5600
First observation:	1973	Slope/aspect: 0-35% / SE TO SW
Last observation:	1994-05-31	Size (acres): 120

Location:

RATTLER GULCH, CA. 5 MILES WEST OF DRUMMOND. SUBPOPULATIONS EXTEND FROM EAST OF RATTLER GULCH ROAD FOR 1 MILE, AND WEST FOR 2 MILES TO MULKEY GULCH.

Element occurrence data:

1984 RATTLER GULCH SUBPOPULATION OF 1001-10000 PLANTS MUCH REDUCED IN 1990, DUE TO HERBICIDE APPLICATION ON NEARBY PRIVATE LANDS. ADDITIONAL LARGE SUBPOPULATIONS (TOTAL > 100,000 INDIVIDUALS) EXTEND WEST TO MULKEY GULCH. PEAK FLOWERING MOST YEARS IN EARLY JUNE; FINISHED FLOWERING 30 MAY 1992. ADDITIONAL EASTERN SUBPOPULATIONS OBSERVED IN 1993, AND FARTHER EAST IN 1994.

General site description:

DRY, STEEP WEST TO SOUTH FACING SLOPE ABOVE A DRY GULCH; SOILS ROCKY, YELLOWISH, SHALLOW, AND LIMESTONE-DERIVED; WITH SCATTERED PINUS PONDEROSA, JUNIPERUS SCOPULORUM, FESTUCA SCABRELLA, AGROPYRON SPICATUM, ERIGERON COMPOSITUS, ERYSIMUM ASPERUM, PHLOX HOODII,

LESQUERELLA ALPINA. ALSO, LOMATIUM TRITERNATUM, PURSHIA TRIDENTATA, LINUM PERENNE, CRYPTANTHA CELOSIODES, KOELERIA MACRANTHA, CHRYSOTHAMNUS NAUSEOSUS, ACHILLEA MILLEFOLIUM, AGOSERIS GLAUCA, PINUS FLEXILIS, CREPIS OCCIDENTALIS, HAPLOPAPPUS ACAULIS, PHLOX CAESPITOSA, CENTAUREA MACULOSA, AND ASTRAGALUS MISSOURIENSIS.

Land owner/manager:

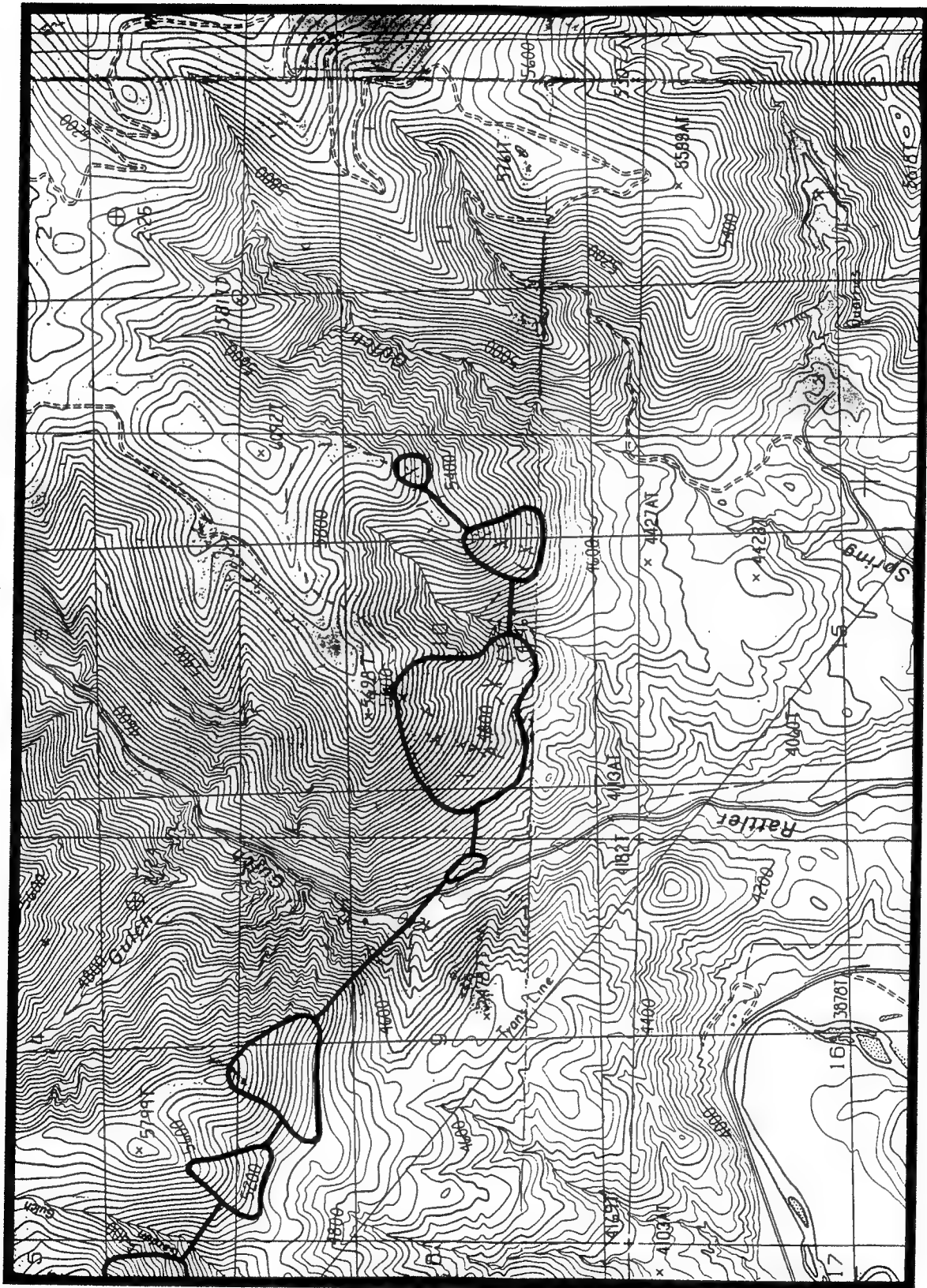
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
BLM: BUTTE DISTRICT, GARNET RESOURCE AREA

Comments:

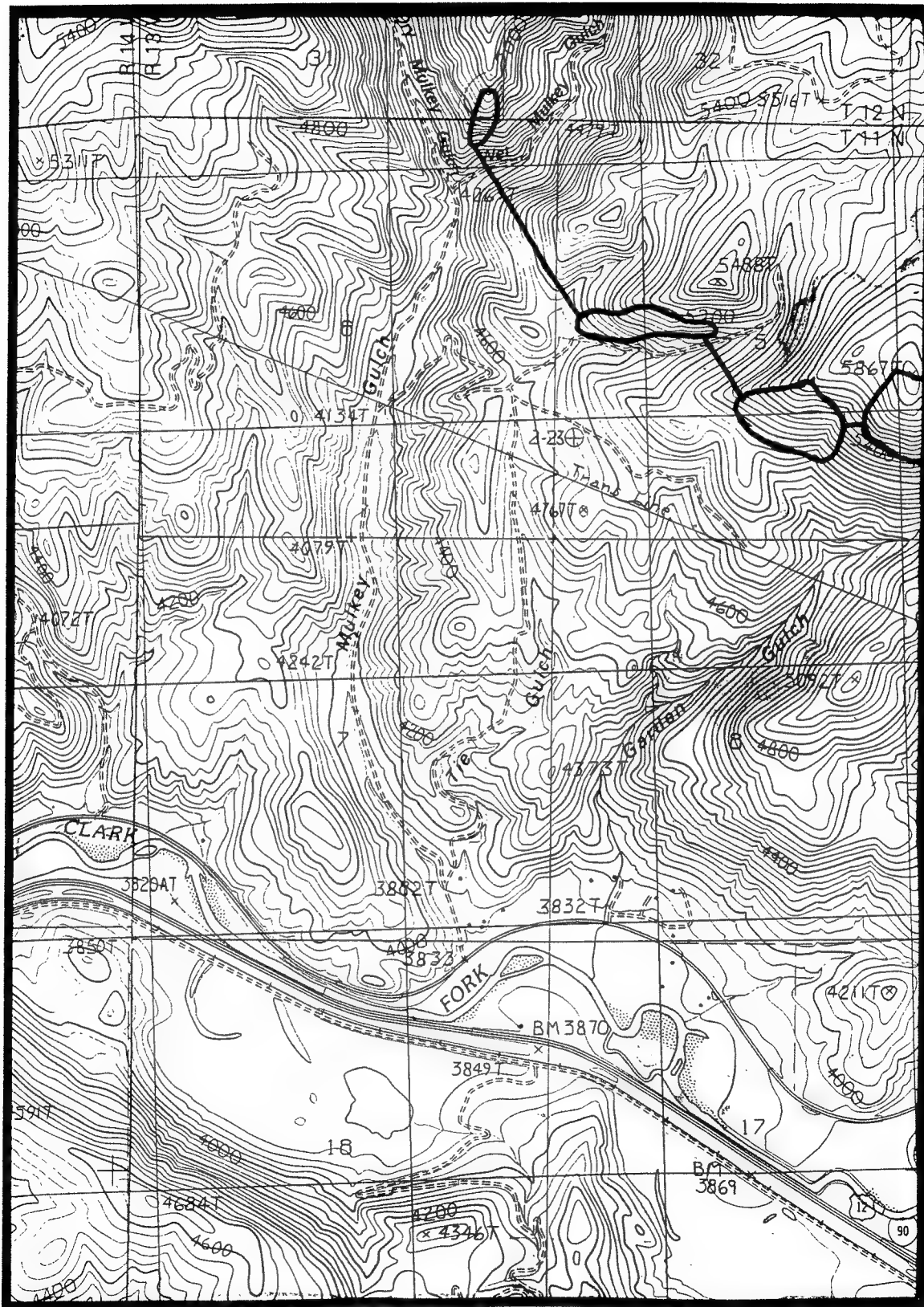
POPULATION COVERS EXTENSIVE AREA, BUT IS RESTRICTED TO A NARROW BAND OF HIGH CALCIUM LIMESTONE. MONITORING TRANSECTS ARE ESTABLISHED IN THREE RATTLER GULCH/MULKEY GULCH SUBPOPULATIONS BY UNIVERSITY OF MONTANA. THE DRIEST OF THE THREE SITES IS IN RATTLER GULCH, WHICH HAD HIGH MORTALITY AND LOW REPRODUCTION DUE TO SEVERE SPRING ON 1992.

Information source: GREENLEE, JACK. DIVISION OF BIOLOGICAL SCIENCES, UNIVERSITY OF MONTANA, MISSOULA, MT 59812.

Specimens: VANDERHORST, J. (5171, 5172). 1994. MONTU.
SCHASSBERGER, L. A. (260). 1989. MONTU.
SCHASSBERGER, L. A. (364, 366). 1990. GH.
LACKSCHEWITZ, K. (7172, 7373). 1977. SPECIMEN #s 78623 & 78624. MONTU.
LESICA, P. (2935). 1984. SPECIMEN #72490. MONTU.



Lesquerella carinata var. languida: Rattler Gulch (003) East
USGS Drummond 7.5' quadrangle



Lesquerella carinata var. languida: Rattler Gulch (003) West
USGS Bearmouth 7.5' quadrangle

MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Scientific Name: LESQUERELLA CARINATA VAR LANGUIDA
Common Name: KEELED BLADDERPOD

Global rank: G2T1 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Element occurrence code: PDBRA1NOB1.004
Element occurrence type:

Survey site name: BEAR CREEK CLIFFS
EO rank: B
EO rank comments: FAIRLY LARGE, VIGOROUS POPULATION; SOME
DISTURBANCE.

County: GRANITE

USGS quadrangle: BEARMOUTH

Township: Range: Section: TRS comments:
011N 014W 11 NE4

Precision: S
Survey date: 1986-05-05 Elevation: 4600 -
First observation: 1986 Slope/aspect:
Last observation: 1989-05-26 Size (acres): 0

Location:

CLIFFS ABOVE EAST SIDE OF BEAR CREEK, 1.3 AIR MILES NNE OF BEARMOUTH,
CA. 0.4 AIR MILES NORTH OF CLARK FORK.

Element occurrence data:

1986: 101-1000 INDIVIDUALS, FLOWER AND IMMATURE FRUIT. 1989: 20 PLANTS
RELOCATED.

General site description:

UPPER WEST-FACING SLOPES, CHOPPY LIMESTONE CLIFFS; FESTUCA
IDAHOENSIS/AGROPYRON SPICATUM GRASSLAND, WITH POA SECUNDA, ALYSSUM
SP., BROMUS, CENTAUREA.

Land owner/manager:

PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)

Comments:

NONE.

Information source: LESICA, PETER. DIVISION OF BIOLOGICAL SCIENCES,
UNIVERSITY OF MONTANA, MISSOULA, MT 59812.

Specimens: LESICA, P. (3697). 1986. SPECIMEN #04163. MONTU.

Lesquerella carinata var. languida: Bear Creek Cliffs (004)
USGS Bearmouth 7.5' quadrangle

MONTANA NATURAL HERITAGE PROGRAM
Element Occurrence Record

Scientific Name: LESQUERELLA CARINATA VAR. LANGUIDA
Common Name: KEELED BLADDERPOD

Global rank: G2T1 Forest Service status: SENSITIVE
State rank: S1 Federal Status:

Element occurrence code: PDBRA1NOB1.005
Element occurrence type:

Survey site name: FELAN AND PACKER GULCHES
EO rank: B
EO rank comments: EXTENSIVE Knapweed INVASION.

County: GRANITE

USGS quadrangle: BEARMOUTH

Township:	Range:	Section:	TRS comments:
012N	014W	33	SE4; 34 SW4
011N	014W	03	NW4
012N	014W	34	SW4

Precision:	S	
Survey date:	1990-06-11	Elevation: 4400 -
First observation:	1989	Slope/aspect: 8-35% / SW
Last observation:	1990-06-12	Size (acres): 30

Location:
BEARMOUTH AREA, FELAN AND PACKER GULCHES, CA. 2.3 MILES NORTH OF I-90
UP BEAR CREEK.

Element occurrence data:
1989: TWO LARGE, VIGOROUS SUBPOPULATIONS, FLOWERING AND FRUITING.
1990: POPULATION AT PACKER GULCH WAS GREATLY REDUCED IN SIZE, POSSIBLY
DUE TO DROUGHT, FREEZING, HERBICIDE USE, OR THE SHORT-LIVED NATURE OF
THIS PERENNIAL SPECIES. POPULATION AT FELAN GULCH WAS SLIGHTLY
REDUCED, PROBABLY DUE TO THE SAME CAUSES.

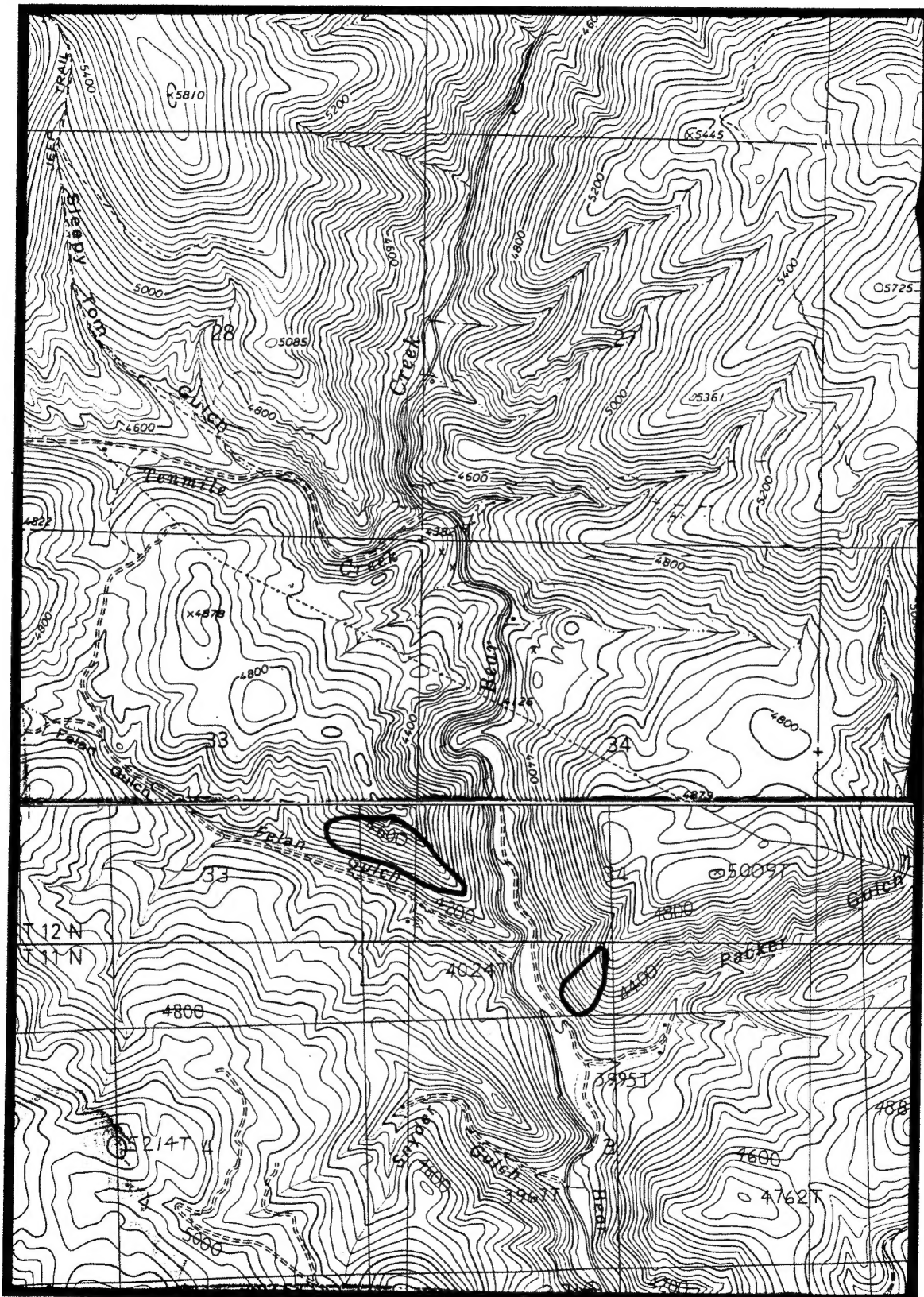
General site description:
ON CALCAREOUS SOILS, WITH PINUS PONDEROSA, JUNIPERUS SCOPULORUM,
PURSHIA TRIDENTATA, ERIGERON COMPOSITUS, MAHONIA REPENS, AND CENTAUREA
MACULOSA.

Land owner/manager:
PRIVATELY OWNED LAND (INDIVIDUAL OR CORPORATE)
BLM: BUTTE DISTRICT, GARNET RESOURCE AREA

Comments:

Information source: SCHASSBERGER, L. A. 1990. [FIELD SURVEYS OF
GRANITE COUNTY OF 11-15 JUNE (LESQUERELLA
CARINATA, PHLOX KELSEYI VAR. MISSOULENSIS, AND
CLAYTONIA LANCEOLATA VAR. FLAVA)].

Specimens: SCHASSBERGER, L. A. (262, 263). 1989. MONTU.
SCHASSBERGER, L. A. (365, 366). 1990. GH.



Lesquerella carinata var. languida: Packer and Felan Gulches (005)
USGS Elevation Mountain and Bearmouth 7.5' quads

